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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/547,844	09/02/2005	Satoshi Sugahara	125209	2196
25944	7590	05/31/2007		
OLIFF & BERRIDGE, PLC P.O. BOX 19928 ALEXANDRIA, VA 22320			EXAMINER SANDVIK, BENJAMIN P	
			ART UNIT 2826	PAPER NUMBER
			MAIL DATE 05/31/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

**Office Action Summary**

Application No.

10/547,844

Applicant(s)

SUGAHARA ET AL.

Examiner

Ben P. Sandvik

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 3/2/2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-3 and 5-86 is/are pending in the application.
- 4a) Of the above claim(s) 18-39, 61 and 66 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-3, 5-17, 40-60, 62-65, 67-71, 79-81 and 83-86 is/are allowed.
- 6) ☒ Claim(s) 72-78 and 82 is/are rejected.
- 7) ☒ Claim(s) 16, 42, 68, 69 and 78 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Election/Restrictions***

This application contains claims 18-39, 61, and 66 drawn to an invention nonelected with traverse in the Response to Election/Restriction filed 8/29/2006. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

### ***Claim Objections***

Claims 16, 42, 68, 69, and 78 objected to because of the following informalities: the term "trans-conductance" has been misspelled. Appropriate correction is required.

### ***Response to Arguments***

Applicant's arguments filed 3/2/2007 have been fully considered but they are not persuasive. Regarding claim 82, the applicant argues that Johnson does not teach that one of the ferromagnetic source and the ferromagnetic drain is formed of a ferromagnetic metal, and the other thereof is formed of a half-metal. The examiner believes that Johnson does teach this limitation, as described in rejection below.

Regarding claim 72, the applicant argues that Ohno does not teach a source and a drain that are formed with ferromagnetic semiconductors and contacted with the semiconductor layer. Fig. 5 of Ohno depicts *composite* source/drain structures 54/56/57 and 53/56/57 that meet all of the limitations of claim 72 and also is in contact with the semiconductor layer 52.

Regarding claim 75, the applicant argues that Hsu does not teach that the semiconductor layer has a channel layer. The examiner believes that Hsu does teach this limitation, as described in rejection below. Hence, the rejection of claims 72-78 and 82 is maintained.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 72, 73, and 78 are rejected under 35 U.S.C. 102(e) as being anticipated by Ohno et al (U.S. PG Pub #2001/0031547).

With respect to **claim 72**, Ohno teaches a transistor comprising a source and drain that are of a first conduction type (Fig. 5, 53, 54, 56, 57), and are formed with ferromagnetic semiconductors (Paragraph 28); a semiconductor layer that is provided associated with the source and the drain (Fig. 5, 52), and has a channel of first conduction type formed therein (formed upon the generation of spin-polarized conduction electrons); and a gate electrode that is formed as opposed to the semiconductor layer (Fig. 5, 55); wherein the source and drain are contacted with the semiconductor layer (Fig. 5, the composite

source/drain structures 54/56/57 and 53/56/57 contact the semiconductor layer 52).

With respect to **claim 73**, Ohno teaches that the semiconductor layer is formed with an undoped semiconductor or an intrinsic semiconductor (Paragraph 28, GaSb).

With respect to **claim 78**, Ohno teaches that the trans-conductance can be controlled in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source (Figs. 1, 2, 6, and 7 demonstrate the effect of spin-polarization on conductance).

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 82 is rejected under 35 U.S.C. 102(b) as being anticipated by Johnson (U.S. Patent #5654566).

With respect to **claim 82**, Johnson teaches a transistor comprising a ferromagnetic source that is formed with a ferromagnetic body from which spin-polarized conduction carriers (Fig. 4, 110); a ferromagnetic drain that is formed with a ferromagnetic body and receives the spin-polarized conduction carriers injected from the ferromagnetic source (Fig. 4, 116); a semiconductor layer that is provided between the ferromagnetic source and the ferromagnetic drain, and form junctions with the ferromagnetic source and the ferromagnetic drain (Fig. 4, 112); and a gate electrode that is formed associated with the semiconductor

layer (Fig. 4, 122); wherein one of the ferromagnetic source and the ferromagnetic drain is formed of a ferromagnetic metal (Col 12 Ln 37-38), and the other thereof is formed of a half-metal (Col 12 Ln 14, "Heusler alloy").

Claim 75 is rejected under 35 U.S.C. 102(e) as being anticipated by Hsu et al (U.S. Patent #6753562).

With respect to **claim 75**, Hsu teaches a source that is formed with a first pn junction (Fig. 3a, 102) between a first ferromagnetic semiconductor and a semiconductor layer that are of different conductive types from each other (Fig. 3a, 101 and Col 9 Ln 58-63); a drain that is formed with a second pn junction (Fig. 3a, 103) between a second ferromagnetic semiconductor and the semiconductor layer that are of different conductive types from each other; and a gate electrode that is formed associated with the semiconductor layer (Fig. 3a, 104), wherein the semiconductor layer has a channel region (Fig. 3, 100).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 74 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohno, in view of Johnson.

With respect to **claim 74**, Ohno does not teach that the channel length is equal to or shorter than the mean free path associated with carrier energy relaxation. Johnson teaches that the channel length is equal to or shorter than the mean free path associated with carrier energy relaxation (Col 10 Ln 60-63). It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the channel length as taught by Johnson in order to control the resistance between the source and drain.

Claim 76 rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu, in view of Johnson.

With respect to **claim 76**, Hsu does not teach that the channel length is equal to or shorter than the mean free path associated with carrier energy relaxation. Johnson teaches that the channel length is equal to or shorter than the mean free path associated with carrier energy relaxation (Col 10 Ln 60-63). It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the channel length as taught by Johnson in order to control the resistance between the source and drain.

Claim 77 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohno, in view of Hsu.

With respect to **claim 77**, Ohno does not teach that when the relative magnetization of the ferromagnetic drain with respect to the ferromagnetic source is antiparallel magnetization, the drain current is lower than the drain current in a case of parallel magnetization. Hsu teaches that when the relative magnetization of the ferromagnetic drain with respect to the ferromagnetic source is antiparallel magnetization, the drain current is lower than the drain current in a case of parallel magnetization (Col 9 Ln 3-8). It would have been obvious to one of ordinary skill in the art at the time the invention was made to operate the transistor of Ohno based on the teachings of Hsu in order to use the device as a non-volatile memory element.

***Allowable Subject Matter***

Claims 1-3, 5-17, 40-60, 62-65, 67-71, 79-81, and 83-86 are allowed.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not



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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben P. Sandvik whose telephone number is (571) 272-8446. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on 571-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

bps

  
**EVAN PERT**  
**PRIMARY EXAMINER**